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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/780,863	02/19/2004	Soon Hyung Hong	2236.0010000/JUK/SMW	1952

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EXAMINER	
LAZORCIK, JASON L	
ART UNIT	**PAPER NUMBER**
1731	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/03/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/780,863	HONG ET AL.	
	Examiner	Art Unit	
	Jason L. Lazorcik	1731	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 November 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/02/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-7 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang et al. (J. Mater. Chem., 2001, 11, 1722-1725). Briefly, Hwang teaches a process of forming a carbon nanotube reinforced ceramic nanocomposite. As indicated by Applicant in the reply to Office Action dated November 2, 2006, the Hwang reference teaches sonication of the CNT solution for 10 minutes but it fails to explicitly provide for an extended sonication period of between 2 and 10 hours. However, Hwang clearly indicates that a stable and homogeneous suspension is critical to the quality of the product derived from the disclosed process, and that said suspension is achieved through the sonication step. It would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the sonication period in order to achieve a homogeneous dispersion of CNTs.

As further evidence of Examiners assertion, Applicant is directed to the general teachings of Smalley et. al. (J. Nanosci. Nanotech, 2003, V3 (1), 81-86) which elucidated the relationship between sonication time and CNT dispersion in aqueous solution for timeperiods up to approximately 5 hours. With specific attention to the immediate reference Figure 2, Smally tracks the intensity of a spectral feature indicative of dispersion quality as a function of time under continual sonication. The reference teaches that dispersion quality increases at least through the first four hours of sonication. It is the Examiners position that optimization of the sonication time was a recognized result effective variable of the dispersion quality at the time of the invention and that said time period would have been optimized through routine experimentation by one of ordinary skill in the art.

Therefore as presented in the prior Office Action regarding Claim 1, the instant reference teaches:

1. Adding carbon nanotubes (CNTs) to an aqueous solution of cetyltrimethylammonium bromide which is read as dispersing carbon nanotubes in a dispersion medium (Pg. 1722, Column 1,Lines 38-40)
2. Sonicating the solution or "dispersion" from (1) above (Pg. 1722, Column 1,Lines 40)
3. Adding sodium silicate and sodium aluminate to the sonicated solution from (2) above which is understood as dispersing a water-soluble salt in the sonicated dispersion. (Pg. 1722, Column 1,Lines 42-44)
4. Sonicating the solution or "dispersion" from (3) above (Pg. 1722, Column 1,Lines 44)

5. Placing the solution into an autoclave ant heating at ~110oC to form a yellowish silicate powder followed by calcinations in air at 400oC to oxidatively remove surfactant molecules (Pg. 1722, Column 2,Lines 2-3). This disclosure is read in the immediate claim as drying and calcinating the sonicated dispersion of (4) where the water soluble salt or sodium silicate forms a ceramic matrix of SiO2 post-calcination. Steps 1-5 yield a ceramic nanocomposite powder referred to by the authors as SiO2-CNT rods wherein the CNTs are homogeneously encapsulated by or "dispersed in" a SiO2 ceramic matrix (Pg. 1724, Column 1, Lines 11-12).
6. The SiO2-CNT rods from (5) are mixed with SiO2 powder and pressed into a disc followed by calcination or "further drying" in air at 400oC and calcination in an N2 atmosphere at 1050oC to form a final composite disc.

Claim 2 is obvious in the rejection of Claim 1 above wherein it was set forth that the CNT dispersion is an aqueous solution.

Claim 3 is obvoius in light of the rejection of Claim 1 wherein sodium silicate and sodium aluminate are understood to be metal-based salts of the metals Silicon an Aluminum, respectively, and at least the sodium silicate is capable of being formed into a SiO2 ceramic matrix prior to calcination.

Claim 4 is obvious in light of the rejection of Claim 1 wherein a ceramic matrix of SiO2 is from the group including silicon oxides.

Claim 5 is obvious in light of the rejection of Claim 3 and the rejection of Claim 1 wherein a ceramic matrix of SiO2 is from the group including silicon oxides.

Claim 6 is obvious in light of the rejection of Claim 1 above wherein the claimed drying temperature range of 80 to 100oC is understood to be encompassed by ~110oC or "approximately" 110oC.

Alternately if it is deemed that "approximately" 110oC fails to read upon the disclosed temperature range, it would be obvious to one of ordinary skill in the art, seeking to dry a dispersion, to perform said drying step within a temperature range suitable for evaporating the dispersion medium. In the immediate case wherein said dispersant is water with a normal boiling point of 100°C, drying said dispersant at approximately 110°C would obviously encompass drying the dispersant in the temperature range of 80°C to 100°C since the latter range would yield materially equivalent drying effect.

Regarding Claim 7, the claim requires a calcinations temperature of 400oC or lower. Hwang indicates that "the silicate powder" described in the rejection of Claim 1 above is calcined in air at 400oC to oxidatively remove surfactant molecules and therefore anticipating the claim. It is noted that the range of 300 to 350oC appears to be a preferred range, but the claim is not limited as such.

With respect to Claim 9, the claim requires a calcinations temperature of 400oC or lower. Hwang indicates that "the silicate powder" described in the rejection of Claim 1 above is calcined in air at 400oC to oxidatively remove surfactant molecules. As such the Hwang process reads on the broad limitation of the claim which requires a calcination temperature of 400oC or less. Further, where

no distinction is drawn between the process of drying and the process of calcination, it is understood that the act of heating the silicate powder to the calcination temperature inherently requires traversing the claimed temperature range of 300 to 350oC. Since the primary solvent utilized by Hwang is water as indicated above, with a normal boiling point of 100oC, the act of heating the silicate powder through the temperature range of 300 to 350oC is understood to "further dry" said ceramic matrix.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang (J. Mater. Chem., 2001, 11, 1722-1725) as applied to Claim 1 above and in further view of Chang (6,420,293). Hwang teaches that the SiO_2-CNT powder is to be calcinated in an N_2 atmosphere at 1050°C which falls within the claimed temperature range of 400-1700°C. Hwang fails to explicitly set forth that the calcination of the ceramic matrix, requiring a calcination temperature of 400°C or higher as indicated above, should be performed under a high vacuum as claimed. Chang teaches that "heating of carbon nanotube materials at elevated temperatures in an oxidizing environment typically results in chemical changes in the surface of the particles (Column 3, Lines 51-54) and specifically that "heating in air at 640°C results in the formation of carboxyl and carbonyl groups at the particle surface" (Column 3, Lines 57-59). Both the N_2 atmosphere and a high vacuum environment are commonly utilized and well appreciated in the art as non-oxidizing environments. Processing under a high vacuum would be an obvious alternative for the nitrogen atmosphere since the Hwang process utilizes calcination temperatures of 1050°C and damage to the CNTs occurs at temperatures in excess of 640°C under oxidative

environments as indicated by Chang. Therefore it would be obvious to one of ordinary skill in the art seeking to minimize said oxidative damage to substitute a high vacuum environment for the nitrogen atmosphere in the Hwang process since both nitrogen and high vacuum provide the requisite non-oxidative environments.

Response to Arguments

Applicant's arguments with respect to claim1-9 have been considered but are moot in view of the new ground(s) of rejection.

With this point in mind, the Examiner has found applicant's argument that the presence of a surfactant "may prevent" the formation of a ceramic matrix between the nanotubes and water soluble salt substantially lacking scientific merit. This is particularly evident given that Applicant admits that during the calcinations step, the surfactant "will be vaporize or pyrolyzed".

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action

is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason L. Lazorcik whose telephone number is (571) 272-2217. The examiner can normally be reached on Monday through Friday 8:30 am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Griffin can be reached on (571) 272-1189. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JLL

DIONNE A. WALLS MAYES
PRIMARY EXAMINER